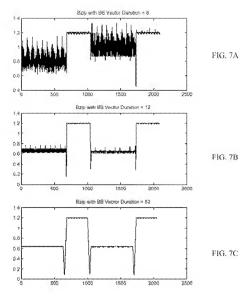


FIG. 3

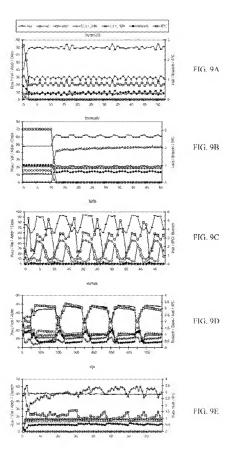
CALDER et. al., SN: 10459,066 Greer, Burns & Crain Ltd. (SPF) GBC Ref. No.: 0321,68199 Replacement FIG. 7A, 7B, 7C



Instruction Cache	32k 2-way set-associative, 32 byte blocks, 1 cycle latency
Data Cache	64k 4-way set-associative, 32 byte blocks, 2 cycle latency
Unified 1.2 Cache	1 Meg 4-way set-associative, 32 byte blocks, 12 cycle latency
Branch Predictor	hybrid - 8-bit gshare w/ 8k 2-bit predictors + a 8k bimodal predictor
Out-of-Order Issue	out-of-order issue of up to 8 operations per cycle, 128 enty re-order buffer
Mechanism	load/store queue, loads may execute when all prior store addresses are known
Architecture Registers	32 integer, 32 floating point
Functional Units	8-integer ALU, 4-load/store units, 2-FP adders, 2-integer MULT/DIV, 2-FP MULT/DIV
Virtual Memory	8K byte pages, 30 cycle fixed TLB miss latency after earlier-issued instructions complete

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CALDER et. al., SN: 10/659,966 Greer, Burns & Crain Ltd. (SPF) GBC Ref. No.: 0321 66:199 Replacement FIG. 9A, 98: 9C, 9D, 9E



name	ini	period	pandq	run	IPC	duniss	i miss	val miss	addr miss
bzip	2	6	4.2%	75.8%	2.681	1.7%	0.000%	25.1%	13.3%
hydro	S	17	0.4%	68.7%	0.793	14.6%	0.022%	8,3%	%9'0
tomcat	13	ro	0.8%	59.6%	0.955	9.7%	0.043%	46.2%	1.0%
vortex	40	144	0.6%	43.4%	2.726	0.9%	0.979%	15.2%	16.4%
vpr	4	2	9.3%	49.8%	1.143	3.0%	0.001%	16.6%	14.2%
wave	88	92	0,6%	62.2%	2.596	7.4%	0.000%	38.1%	7.9%

15.12

LI:	17.9%	9.1%	17.1%	0.7%	1.3%	7.8%
addr	15,7%	0.6%	0.9%	16.3%	14.4%	8.5%
err	1.1%	1.8%	12.4%	0.1%	0.0%	6.1%
TEX.	25.4%	8.2%	41.1%	15.2%	16.6%	40.4%
LT.	ì	i	1	2.8%	,	ì
inst	%0.0	%0.0	%0.0	% %	0.0%	0.0%
tta	25.8%	1.5%	1.1%	1.2%	6.4%	4.4%
data	1.3%	14.8%	9.8%	0.9%	3.1%	7.7%
EII.	5.1%	2.5%	1.5%	1.9%	4.3%	3.3%
IPC	2.8	9.0	6.0	2.8	1.2	5.5
err	0.5%	1.7%	5%	0.8%	0.3%	2.5%
108	75.4%	69.8%	60.5%	43.7%	49.7%	60.7%
ΕŒ	<u>%</u>	8%	3%	%2	3%	98
paudq	4.2%	0.3%	0.8%	99.0	9.0%	9970
start	8	©	1.2	382	746	127
name	bzíp	liydro	tomcat	vortex	vpr	wave

FIG. 1

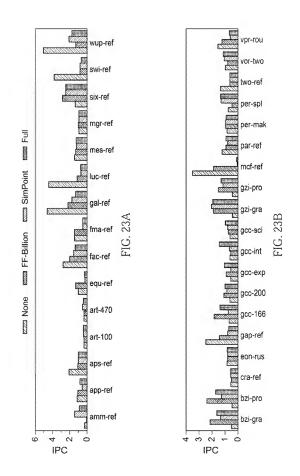
ue	82.0%	9.3%	13.7%	7.7%	1.3%	20.8%
addr	7.3%	0.6%	81.1	17.7%	14.4%	6.5%
err	77.2%	0.4%	16.2%	3.8%	0.0%	2.8%
val	14.2%	8,4%	39.8%	15.7%	969.91	37.0%
err	t	ŧ	1	4.0%	,	ì
inst	0.0%	%0.0	%1.0	.0%	0.0%	0.0%
err	8.0%	34.	2.0%	16.3%	6.4%	6.7%
data	1.8%	14.8%	9.5%	0.7%	3.1%	7.9%
EII	5.9%	3.9%	1.9%	3.4%	4.3%	80.9
IPC	2.5	8.0	9	2.8	1.2	2.8
err	18.8%	0.9%	2.2%	3.6%	0.3%	1.2%
านย	63.8%	69.2%	60.9%	41.9%	49.7%	61.5%
err	9%9	%	<u>%</u>	38	3%	84%
paudq	4.0%	0.3%	0.8%	9,970	9.0%	0.3%
start	1733	36	#	330	746	1036
name	dizq	hydro	tomcat	vortex	vpr	wave

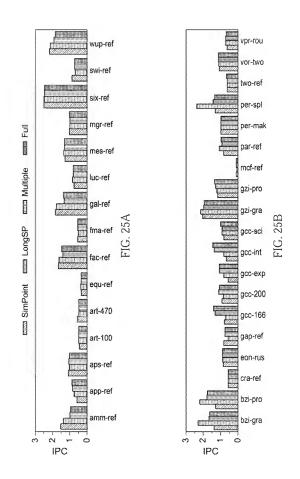
FIG. 12

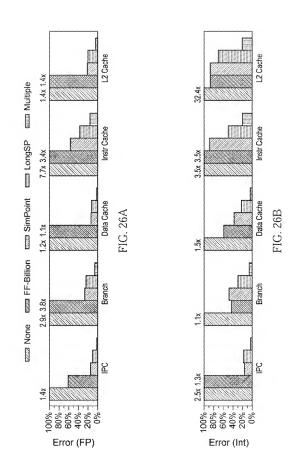
Lle GLL	55.4%	8.6%	237%	1.6%	2.6%	2.3%
addr	8.5%	0.6%	0.3%	16.2%	13.8%	7.7%
err	10.8%	1.8%	6.1%	2.3%	0.2%	5.5%
rs.	22.7%	8.5%	44.0%	14.8%	16.6%	40.1%
err	ì	i	1	36%	,	,
inst	%0.0	0.0%	%0.0	0.7%	0.0%	9600
EII	68.9%	1.7%	5.1%	6.1%	621%	1.1%
data	2.8%	14.8%	10.1%	%6.0	0.4%	7.3%
EII	23.2%	2.4%	4.6%	17.6%	162%	9.1%
IBC	2.2	8.0	6.0	3.2	3.0	2.4
en	2.0%	1.4%	2.4%	6.9%	16.6%	3.8%
nna	74.3%	69.6%	90.19	46.4%	58.1%	80.5%
Ha	17%	32%	28%	42%	740%	55%
paidq	4.9%	0.3%	0.6%	0.4%	2°	0.9%
start		22	<u>«</u>	184	ထ	138
เลกะ	dizq	liydro	tomcat	vortex	vpr	BARA

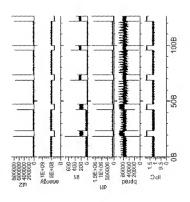
FIC 13

MISUUCION CACHE	8k 2-way set - associative, 32 byte blocks. I cycle latency
Data Cache	16k 4-way set-associative, 32 byte blocks, 2 cycle latency
Unified 1.2 Cache	1 Meg 4-way set-associative, 32 byte blocks, 20 cycle latency
Memory	150 cycle round trip access
Branch Predictor 1	hybrid - 8-bit gshare w/ 8k 2-bit predictors + a 8k bimodal predictor
Out-of-Order Issue	out-of-order issue of up to 8 operations per cycle, 128 enty re-order buffer
Mechanism	load/store queue, loads may execute when all prior store addresses are known
Architecture Registers 3	32 integer, 32 floating point
Functional Units 8	8-integer ALU, 4-load/store units, 2-FP adders. 2-integer MULT/DIV, 2-FP MULT/DIV
Virtual Memory 8	8K byte pages, 30 cycle fixed TLB miss latency after earlier - issued instructions complete









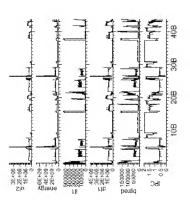


FIG. 27B

FIG. 27A

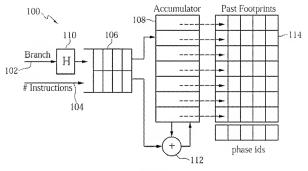


FIG. 28

Misclassifications

CALDER et al., SN: 10459,066 Greer, Burns & Crain Ltd. (SPF) GBC Ref. No.: 0321,68199 Replacement FIG. 32

FIG. 32

Phose   PC   (studen)   bpred   (studen)   dil   (stude			1-	-	-		-		,	1	-	-		-
phase         IPC (studev)         bpred (studev)         dil (studev)         ii (studev)         mergy (studev)           full         1.32 (43.4%)         27741 (135.5%)         445063 (110.7%)         50.763 (203.2%)         6.44E-08 (90.0%)         22           18.5%         0.61 (1.6%)         27741 (135.5%)         445063 (110.7%)         75 (23.2%)         6.44E-08 (90.0%)         28           11.8         1.95 (0.3%)         13048 (12.9%)         28112 (15.1%)         43 (73.9%)         3.22E-08 (0.2%)         1.32E-08 (0.2%)           7.2%         0.64 (0.2%)         10145 (15.1%)         885081 (0.1%)         75 (215.5%)         4.20E-08 (1.1%)         3.3FE-08 (1.1%)           9.9%         1.76 (1.6%)         2015 (1.6%)         102564 (6.8%)         15591 (5.2%)         4.20E-08 (1.1%)         1.1%           1.0         1.45 (1.6%)         2015 (1.1%)         98947 (5.9%)         102 (45.1%)         3.5FE-08 (1.6%)           1.7         1.24 (3.4%)         56045 (11.1%)         90446 (58.2%)         60 (138.1%)         482E-08 (1.3%)           1.7         1.24 (3.4%)         54973 (11.5%)         9650 (10.1%)         11 (44.2%)         5.09E-08 (13.5%)           8.8         1.7         (0.6%)         56449 (4.8%)         37331 (5.6%)         414.2%	(stddev)	(139.7%)	(5.3%)	(5.6%)	(0.1%)	(7.0%)	(12.6%)	(stddev)	(112.0%)	(8.6%)	(9.3%)	(15.6%)	(11.0%)	(8.4%)
phase         IPC (studev)         ppred (studev)         dfl (studev)         dfl (studev)         dfl (studev)         energy (studev)	OI2	227912	395997	1006	443655	354084	15595	ZIn	22880	24218	24518	5617	28153	23701
phase         IPC (studev)         bpred (studev)         dl1 (studev)         ii1 (studev)         ii1 (studev)           18.5%         1.32 (43.4%)         27741 (135.5%)         445083 (110.7%)         50783 (203.2%)           18.5%         0.61 (1.6%)         3.4665 (22.0%)         753.882 (5.4%)         125091 (23.2%)           18.1%         1.96 (0.3%)         130.48 (3.5%)         28112 (15.1%)         4.3 (73.9%)           4.0%         1.0.3%         101.48 (7.6%)         705.89         705.84 (6.3%)         15.20           3.9%         1.76 (1.6%)         2015 (13.6%)         98947 (5.9%)         102 (45.1%)           phase         IPC (studev)         bpred (studev)         dl1 (studev)         ii1 (studev)           17.1%         1.3 (16.3%)         56045 (11.1%)         90446 (56.2%)         60 (138.1%)           17.1%         1.24 (3.4%)         53300 (10.8%)         96960 (10.1%)         11 (46.5%)           9.8%         1.22 (4.3%)         54791 (6.8%)         99620 (10.1%)         11 (46.5%)           9.8%         1.22 (4.3%)         54791 (6.8%)         99620 (10.1%)         11 (46.5%)           9.8%         1.76 (0.6%)         54949 (4.8%)         99620 (10.1%)         11 (46.5%)           9.8%         1.72 (4.3%)<	(stddev)	(%0.06)	(1.8%)	(0.2%)	(0.3%)	(1.1%)	(1.6%)	(stddev)	(13.5%)	(3.5%)	(3.8%)	(%9.0)	(4.4%)	(3.2%)
phase         IPC (studev)         bpred (studev)         dil (studev)         ii (studev)	energy	6.44E+08	1.03E+09	1		4.20E+08	3.57E+08	energy	4.82E+08	5.05E+08	5.09E+08	3.55E+08	5.14E+08	5.04E+08
Phase   IPC   (studev)   Phred   (studev)   Although   (studev)	(stddev)	(203.2%)	(23.2%)	(73.9%)	(215.5%)	(5.2%)	(45.1%)	(stddev)	(138.1%)	(44.2%)	(45.5%)	(8.4%)	(25.7%)	(35.4%)
Phose   PC (studev)   Dpred (studev)   df1 (4   45   45   45   45   45   45   45	Ξ	50763	125091	43	75	15591	102	Ξ	09	12	#	241	40	12
phase         IPC (studev)         bpred (studev)           full         1.32 (43.4%)         27741 (135.5%)           18.1%         0.61 (16%)         34665 (20%)           17.2%         0.64 (0.3%)         13048 (15.1%)           4.0%         1.49 (1.2%)         10145 (15.1%)           phase         IPC (studev)         bpred (studev)           full         1.33 (16.3%)         56045 (11.1%)           17.7         1.24 (3.3%)         56045 (11.1%)           9.4%         1.23 (16.3%)         54973 (11.5%)           8.8%         1.76 (0.6%)         56449 (4.8%)           7.4%         1.22 (4.3%)         54791 (6.8%)           7.4%         1.22 (4.3%)         561515 (11.1%)	(stddev)	(110.7%)	(5.4%)	(15.1%)	(0.1%)	(6.8%)	(2.9%)	(stddev)	(58.2%)	(10.1%)	(11.3%)	(2.6%)	(11.9%)	(9.6%)
hase IPC (stddev) byred [182, 43.4%] 27741 (183, 181, 182 (43.4%) 27741 (183, 181, 181, 182 (43.4%) 27141 (183, 181, 181, 181, 181, 181, 181, 181,	£	1 7 1	753382		885081	703554	98947	<b>d</b>	90446			37331	99671	96701
Phrase   IPC (studey)	(stddev)	(135.5%)	(22.0%)	(3.9%)	(15.1%)	(7.6%)	(13.6%)	(stddev)	(11.1%)	(10.8%)	(11.5%)	(4.8%)	(6.8%)	(11.1%)
horase IPC (6 18.5% 0.61 13.2 (8.5% 0.64 14.9 13.9% 1.76 17.7% 1.76 17.7% 1.76 17.7% 1.76 17.7% 1.24 1.24 1.24 1.24 1.24 1.24 1.24 1.24	pbred	27741	34665	13048	843	10145	2015	pbred	56045	53300	54973	56449	54791	55215
hase full 18.5% (18.5% (18.1%	(stddev)	(43.4%)	(4.6%)	(0.3%)	(0.2%)	(1.2%)	(1.6%)	(stddev)	(16.3%)	(3.4%)	(3.8%)	(0.6%)	(4.3%)	(3.1%)
# 1			0.61	1.95	0.64	1.49	1.76	PC	1.33	1.24	1.23	1.76	1.22	1.24
gcc gzip	phase	2	18.5%	18.1%	7.2%	4.0%	3.9%	phase	Þ	17.1%	9.4%	8.8%	8.0%	7.4%
	L		{	gcc						g	zip			

FIG. 33

